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SOME NEW SEMI-AQUATIC HEMIPTERA FROM SOUTH AMERICA WITH A RECORD OF STRIDULATORY DEVICES. (VELIIDAE-VELIA.)

By

H. B. HUNGERFORD, University of Kansas.

During the past year I have had an opportunity to examine practically all the types in the genus Velia and have found in the undetermined materials in various collections, including my own, several new species to add to this genus. My special interest in publishing this paper, however, is to call attention to some good specific characters not hitherto used and to record the presence of stridulatory devices on some of these new species. Stridulation in some of the true Aquatic Hemiptera has been known for a long time. Corixidae, Nepidae, and some of the Notonectidae produce sounds. In the first and last named families, the talent appears to be confined to the males and in all three the stridulatory patches are on the front legs.

I do not recall having seen any record of stridulation among the Semi-aquatics. In all of the new species desscribed below there is a stridular patch on the inside of the hind femur which obviously rasps against a row of pegs on a raised ridge that lies along the side of the abdomen just beneath its margin. (See the plates.) Moreover, the devices are present in the females as well as in the males in the three species where both sexes are available for study.

Velia strigosa species new.

Size: 4.5 mm. long; 0.8 mm. wide across the head; 1.1 mm. across the widest part of the pronotum; 1.2 mm. across the widest part of the thorax.

Color: Dorsum dark blackish brown. Head median longitudinal carina of pronotum, lateral margins of the connexivum and legs testaceous. Anterior part of pronotum with two large roughly triangular silvery patches of slender scale like hairs. Wing pads, silvery white and covered with the same sort of silvery flattened hairs. A grayish or frosty, somewhat interrupted band on sides of thorax and abdomen.

Structural Characteristics: This is a slender long legged species with the connexivum caudally produced into a sharp spine. This spine is three-fourths as long as the length of the last abdominal segment

measured on its median line. Pronotum with a median longitudinal carina, the general surface pitted, each pit lined with silvery hair. Abdominal dorsum appears to have a rough surface due to the short, depressed regularly spaced hairs. The lateral margins of the four anterior abdominal segments appear denticulate due to the submarginal row of stridular pegs which are visible from above. Ventral portion of abdomen and the meso- and metasternum with short depressed hairs, longer hairs on rear margin of abdominal segments and on the mesosternum. Sides of thorax bare and surface made uneven by pits and etched-in figures, the shiny bottoms of which appear pebbled, (under the binocular using 3.5 X ocular and 25 mm. objective). First three abdominal segments with transverse grooves, that of the second segment longest reaching from connexivum nearly to median ventral line of abdomen. A row of about thirty stridular pegs on the connexiva just beneath the lateral margin and extending from thorax to distal end of fourth abdominal segment. At anterior end of the row the pegs are placed quite far apart becoming more crowded toward caudal end. (See Plate I figure 1). Mesosternum with a broad longitudinal groove. Metasternum with a median elevation or ridge that is projected caudally slightly. Male genital claspers thin, shape as shown on Plate 1, figure 7. Antenna 3.64 mm. with the segmental formula as follows:

1st: 2nd: 3rd: 4th: :6.5: 4.6: 4*: 3.1.

Middle legs considerably longer than the hind legs. Hind femora of male slender and provided with a stridular patch as shown on Plate II. fugure 4.

This species is described from two males labeled "Museum Paris. Guyane Haut-Carsevenne, F. Geay 1898." Holotype is a male in the "Museum National d'Histoire Naturelle Laboratoire d'Entomologie, Paris." Paratype in the Entomological collection of the University of Kansas.

Velia raspa species new.

Size: 5 mm. long; 0.9 mm. across the head; 1.26 mm. across the widest part of the pronotum in the male and 1.4 mm. in the female; 1.4 mm. to 1.5 mm. across the widest part of the thorax.

COLOR: General effect brown, varying from dark brown to redish brown with paler indistinctly triangular

* Includes minute segment at base.

patches on segments of the connexiva and legs banded with pale testaceous and brown. Head, median longitudinal carina and margin of pronotum, golden brown; wing pads silvery white.

Structural characteristics: A moderately slender species with connexivum ending in a sharp acute angle or short spine. Legs and antennae of normal length, hind femora incrassate and armed with some spurs on rear margin, alike in both sexes. Both sexes provided with a stridular patch on the hind femur and a row of pegs on the side of the abdomen. These pegs are small and close together in the row. (See Plate I. figure 4). Pronotum with median longitudinal carina. Surface of pronotum pitted, the pits lined with short silvery hairs. Abdominal dorsum covered with short depressed hairs. and more sparsely with long slender hairs. Scutellum exposed. Sides of thorax bare and surface made uneven by pits and etched-in figures the shiny bottoms of which appear pebbled. First three abdominal segments with transverse grooves. The median one but slightly longer than the others. A row of minute stridular pegs on the connexivum just beneath the lateral margin and extending from the thorax in a diminishing line until it disappears about the middle of fourth abdominal segment. Mesosternum longitudinally grooved and metasternum roundly elevated on front and sides and abruptly truncated behind. The lateral margins of the last connexival segment parallel. The caudal margin of the seventh ventral abdominal segment (so called sixth ventral segment) is provided with two conspicuous projections as in **Velia quadrispinosa** described below. The male genital claspers as shown on Plate I figure 5. Total length of antenna 3 mm. with the segmental formula as follows: 1st: 2nd: 3rd: 4th: :5.5: 4: 2.8: 2.8.

Middle legs not conspicuously longer than the hind legs. The middle tarsus plainly longer and more slender than the hind tarsus. The ratio between them being 7.25: 4.50. This species is described from one male and four females bearing the following label: "Manacapuru, S. A. Amazonas, Brazil, Solimoes River, June 1928. S. M. Klages."

Holotype, allotype, and paratypes in the University of Kansas Entomological collection.

Velia quadrispinosa species new.

Size: 4.8 mm. long; 0.84 mm. across the head; 1.3

mm. across the widest part of the pronotum and 1.4 mm. across the widest part of the thorax.

Color: As in **Velia raspa.**

Structural characteristics: Very much as in the preceeding species. This species is slightly smaller and the female has four caudal projections on the dorsum of the abdomen. (See Plate 1 figure 11.) The female of **Velia raspa** lacks entirely the two projections on the caudolateral angles of the first genital segment as is also true of the male. The male of **Velia quadrispinosa** however has minute projections present. The differences in the shape of the male genital claspers are shown on Plate 1, figures 6 and 5. The lateral margins of the last connexival segment in the male are divergent. The total length of antenna 2.6 mm. with the segmental formula as follows: 1st: 2nd: 3rd: 4th: :4.6: 3.5: 2.5: 2.5.

Described from a male and a female labeled, "Brazil, Santarem. W. H. Bates." Holotype and allotype in the British Museum. This species is very nearly related to **Velia raspa,** the males having the abdomens of the same general appearance, the shape of the first genital segment in the females however separates the species at a glance. Both species have the scutellum exposed, the sculpturing of the thorax much the same, and the three transverse depressed lines on the first three ventral abdominal segments.

Velia stridulata species new.

Size: 5.4 mm. long; 0.95 mm. across the head; 1.23 mm. across the widest part of the pronotum; 1.5 mm. across the widest part of the thorax.

Color: General effect yellowish-tan with legs banded in testaceous and brown.

Structural characteristics: This is a slender species with rather long legs and antennae. The connexiva ending caudally in sharp pointed divergent spines that are about one-half as long as the length of the last abdominal segment measured on its median line. Pronotum with a median longitudinal carina and the surface sparsely pitted. Vertex of head with a pair of crescent shaped grooves, each arising from a pit at its caudal end. Abdominal dorsum covered with short depressed hairs and more sparsely with long slender hairs. Scutellum not exposed. Sides of thorax as in the species described above. The lateral margins of the four anterior abdominal segments appear denticulate, due to the sub-

marginal row of stridular pegs which are visible from above. This row consists of about twenty-eight equally spaced pegs, the anterior ones largest. The first two ventral abdominal segments, only, with transverse grooves. The second one largest. Mesosternum longitudinally grooved, metasternum roundly elevated and slightly produced caudally. First genital segment with a median ventral projection as shown on Plate I figure 3. Male clasper as shown on Plate I, figure 8. Total length of antenna 4.3 mm. with the segmental formula as follows: 1st: 2nd: 3rd: 4th: :7: 6: 5: 3.5. Middle tibia but little longer than hind tibia. Middle tarsus is to hind tarsus as 8 is to 5. Hind femur incrassate and denticulate as shown on Plate II figure 6. The stridular patch on hind femur large. This species is described from one male labeled, "Museum Paris. Guyane, Haut-Carsevenne. F. Geay 1898."

Holotype in the Museum National d'Histoire Naturelle. Laboratoire d'Entomologie—Paris.

Velia transversa species new.

Size: Small, 3.2 mm. long; 0.64 mm. across the head; 0.85 mm. across the widest part of the pronotum; 0.93 mm. across the widest part of the thorax.

Color: Light brown with two roughly triangular silvery patches on anterior part of pronotum. Venter, tan covered with gray frost.

Structural characteristics: This is a short little species with the middle legs plainly longer than the others. The silvery patches on the pronotum of same structure as those described in **Velia strigosa.** Connexivum terminating in a spinous point. These caudal spines are two-thirds the length of the last abdominal segment measured on its median line. Pronotum with a median longitudinal carina and the surface pitted. These pits are lined with silvery hairs. Abdominal dorsum covered with depressed hairs and more sparsely with longer hairs. Venter, frosty gray, sparsely covered with rather stiff hairs. Sides of thorax sculptured as in preceeding species. First five abdominal segments with transverse grooves. A row of minute, closely set stridular pegs on the connexivum just beneath the margin. These are so small and close together as to appear as a little chitinized ridge when viewed under binocular using 3.5X eyepiece and 25 mm. objective. This is present in both sexes. Stridular patch on the hind femora. Mesosternum with median longitudinal groove and metasternum only

slightly raised. Hind trochanter provided with a spur as shown on Plate II figure 7. Total length of antenna 2.56 mm. with segmental formula as follows:

1st: 2nd: 3rd: 4th: :4: 3.6: 3-: 2.2. Middle leg considerably longer than the hind leg. The middle tibia is to the hind tibia as 8 is to 7.

The male genital clasper as shown on Plate I figure 10. This species is described from a male and female labeled, "Museum Paris, Guyane, Haut-Carevenne. F. Geay. 1898." Holotype is in the Museum National d'Histoire Naturelle Laboratoire d'Entomologie—Paris.

This species is nearer **Velia cinctipes** Champion, than the other species described in this paper, but is a smaller species with differently formed metasternum and with stridular patch on the hind femur and stridular row of pegs on abdomen.

These five new species together with **Velia cinctipes** Champion form a distinct group of the genus Velia. They have a general facies common to all. The sides of the thorax are devoid of hair and sculptured with depressed figures. The middle legs are longest. Two or more of the anterior ventral abdominal segments bear transverse grooves and all of the species, except **Velia cinctipes** Champion, are provided with a stridular patch on the hind femur and with a row of stridular pegs on the submargin of the abdomen.

Key for the Stridulivelia new subgenus.

(Type of the subgenus: **Velia raspa** species new.)

(Only wingless forms available.)

A. First five ventral abdominal segments with transverse grooves. Hind trochanters spurred.

B. Hind femur provided with stridular patch. Metasternum nearly flat. **Velia transversa** species new.

BB. Hind femur without stridular patch. Metasternum broadly connate. **Velia cinctipes** Champion.

AA. First three, at most, ventral abdominal segments with transverse grooves. Hind trochanter not prominently spurred.

B. First two ventral abdominal segments with transverse grooves. First genital segment of the male with a ventral protuberance. **Velia stridulata** species new.

BB. First three ventral abdominal segments with transverse grooves. First genital segment of the

male not as above.

C. Males with a pair of prominent projections on the last ventral abdominal segment. Hind femora incrassate. Scutellum exposed.

D. Female with a pair of spinose projections on the caudal margin of the first genital segment above. Males with minute projections. **Velia quadrispinosa** species new.

DD. Female without the spinose projections on the first genital segment above. **Velia raspa** species new.

CC. Males without projections on the caudal margin of the first genital segment above. Hind femora not incrassate. **Velia strigosa** species new.

EXPLANATION OF PLATES

PLATE I.

Velia—by H. B. Hungerford.

FIGURE 1: Velia strigosa species new. Side view of the abdomen of the male showing the row of stridular pegs against which is rubbed a roughened place on the hind femur. See Plate II, figure 4.

FIGURE 2: Velia quadrispinosa species new. Side view of the abdomen of the male. Note the projection on the last ventral abdominal segment, another one on the opposite side together with the caudally produced connexiva comprise the four spinose projections that suggested the name. (See also figure 11 which is a dorsal view of the female abdomen.) In the female all four processes are on the dorsal side.

FIGURE 3: Velia stridulata species new. Side view of the abdomen of the male. The ventral projection on the first genital segment separates this species from the others.

FIGURE 4: Velia raspa species new. Side view of the abdomen of the female, note the row of stridular pegs as in the males above.

FIGURE 5: Velia raspa species new. The left genital clasper of the male.

FIGURE 6: Velia quadrispinosa species new. The left genital clasper of the male.

FIGURE 7: Velia strigosa species new. The left genital clasper of the male.

FIGURE 8: Velia stridulata species new. The left genital clasper of the male.

FIGURE 9: Velia cinctipes Champion. The left genital clasper of the male.

FIGURE 10: Velia transversa species new. The left genital clasper of the male.

FIGURE 11: Velia quadrispinosa species new. Dorsal view of the abdomen of female shows the projections on the first genital segment. These are lacking in the female of **Velia raspa** species new.

PLATE II.

FIGURE 1: Velia raspa species new. Left hind leg of the male. Note the stridular patch on the femur. This rubs against a row of pegs on the side of the abdomen.

FIGURE 2: Velia raspa species new. Left hind leg of the female.

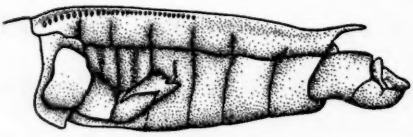
FIGURE 3: Velia quadrispinosa species new. Left hind leg of the male.

FIGURE 4: Velia strigosa species new. Left hind leg of male.

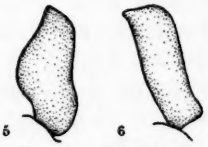
FIGURE 5: Velia cinctipes Champion. Left hind leg of male. Note that it lacks the stridular patch. The trochanter bears a spur.

FIGURE 6: Velia stridulata species new. Left hind leg of a male. In this male the stridular area is quite large.

FIGURE 7: Velia transversa species new. Right hind leg of a male.



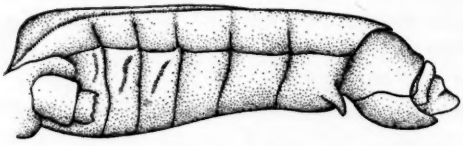
1 Velia strigosa male (side view of abdomen)



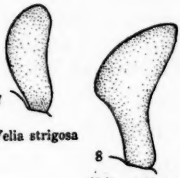
5 Velia raspa

6 Velia quadrispinosa

left claspers

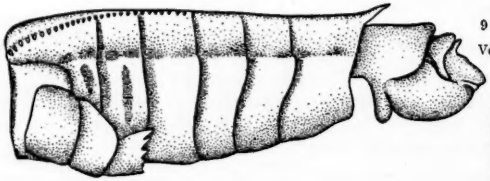


2 Velia quadrispinosa male

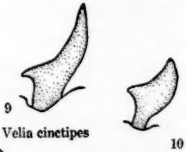


7 Velia strigosa

8 Velia stridulata

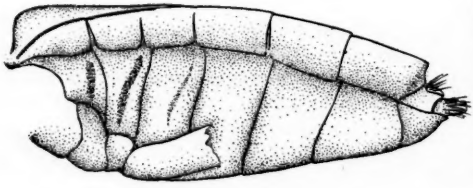


3 Velia stridulata male

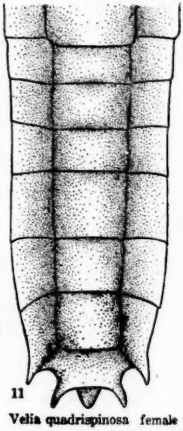


9 Velia cinctipes

10 Velia transversa

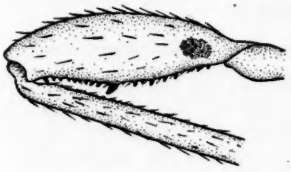


4 Velia raspa female (side view of abdomen)

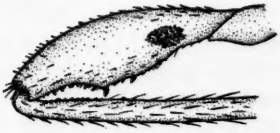


11 Velia quadrispinosa female (dorsal view of abdomen)

PLATE I.



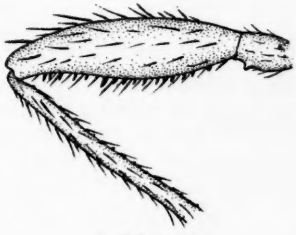
1 Velia raspa male (hind leg)



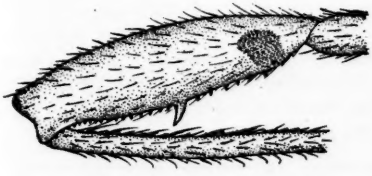
2 Velia raspa female (hind leg)

3 Velia quadrispinosa

4 Velia strigosa



5 Velia cinctipes



6 Velia striduiata

7 Velia transversa

PLATE II.

HYDROCYANIC PENETRATION GAS IN 140 POUND BAGS OF FLOUR UNDER ATMOSPHERIC CONDITIONS*

By GILBERT SCHENK and GEO. A. DEAN, Manhattan, Kansas.

The general opinion expressed by members of the milling industry and in publications dealing with the fumigation of flour and other milled products is that HCN will not successfully penetrate such materials to a depth of over two or three inches. However surprisingly good kills are sometimes found in accumulations of such products overlooked in the preparation of flour mills for fumigation with HCN.

The experiments presented in this paper were planned to determine the minimum amount of HCN necessary, at an exposure allowing one fumigation daily, to overcome the adsorption by the outside layers of 140 lb bags of flour under ordinary conditions of atmospheric vault fumigation. Further experiments were planned to determine the effect of increased temperatures upon the dosage selected from these experiments.

Metal Vault Used. These experiments were conducted in a Standard Plymetl Vault of 480 cubic feet capacity, manufactured by the Haskelite Manufacturing Corporation of Chicago, Illinois.

Liquid HCN Used. Liquid HCN is liquefied hydrocyanic acid gas containing 96 per cent to 98 per cent HCN. This form of cyanide was selected to reduce the probable error of evolution of HCN, since other forms of cyanide require chemical reaction to liberate HCN.

The fumigant was applied through a graduated meter box for volumetric measurement. The cylinder containing the Liquid HCN was attached to the meter box by means of a connecting hose. When the pressure within the cylinder raised the desired dosage into the meter box, the intake valve of the meter box and the outlet valve of the cylinder were closed. The outlet valve of the meter box was then opened and the liquid allowed to flow into the vault by gravity.

About ten pounds pressure was then raised in the

*The experiments presented in this paper were conducted by Mr. Schenk, representing the research department of the American Cyanamid Sales Company, directed by Dr. William Moore, in cooperation with Prof. Dean, director of the mill insect control problems of the Southwestern Millers' League.

meter box by means of an ordinary foot pump and immediately released through the outlet valve to clean the pipe. The meter box used in these experiments was placed overhead about seven feet from the vault. A more convenient location would be adjoining the vault near the floor. This would require but a few inches of pipe from the outlet valve to the vault which would eliminate the necessity of raising the pressure to clean the pipe.

Cane Seed Fumigated During Experiments. The vault was operated by the Central Storage Company of Kansas City, Mo., to sterilize seeds or other infested materials held in storage. The privilege was granted the writers to conduct the flour penetration tests in conjunction with the regular fumigations of an infested lot of cane seed. This cane seed was infested with **Plodia interpunctella** Hbn. (Indian meal moth). From 55 to 57 bags of cane seed were fumigated during each experiment.

Relative Humidity and Temperature. The relative humidity during the experiments ranged between 25 per cent and 40 per cent.

The infestation was not in an active stage and the normal temperatures of the stored seed ranged around 40 degrees F.; the temperature of the floor on which the seed and vault were located ranged from slightly below freezing to about 60 degrees F., depending upon outside weather conditions. A temporary enclosure, large enough to hold about 120 bags of cane seed, weighing approximately 150 lbs. each, was built around the vault. This enclosure was kept at temperatures between 75 degrees F. and 85 degrees F. by means of a large heating stove.

Twice the number of bags necessary to fill the vault were placed within the enclosure, until the Plodia larvae became active and began to move about on the outside of the bags which required about 48 hours. Each time the vault was filled an equal number of bags were brought within the heated enclosures. When no fumigation was to be conducted for a period of several days, the fire was allowed to die down.

The vault was equipped with two electric heaters having high, medium, and low temperatures. The heat was turned to "high" during the early part of the exposure, until the temperature within the vault during fumigation was above 60 degrees F., which was about the average temperature reached by the cane seed

within the enclosure. The switch was then turned to "low" or "medium", depending on surrounding temperatures, for the balance of the exposure. In most instances, the temperature reached 70 degrees F. by the end of the fumigation period. During experiment 13, the temperature within the vault was controlled by the stove within the enclosure and ranged around 70 degrees F. It is possible that the temperature within the vault increased at periods when the fire was replenished, for no hourly records were kept.

Samples of Flour and of Cane Seed Analyzed for Residual HCN. Samples of the flour and of the cane seed exposed for 20 hours at the one and one-half pound dosage were analyzed to determine the amount of HCN adsorbed. The bags were removed from the vault and stacked in the wareroom outside the heated enclosure. Samples were not taken until two hours after removal from the vault in order that any excessive free gas might escape.

The chemical analyses of these samples were made by the Technical Department of the American Cyanamid Company, New York.

Preparation and Placing of Check Boxes. Adult specimens of **Tribolium confusum** Duv. (confused flour beetle) were used in all experiments. One and one-half inch circular cardboard pill boxes were used as check boxes. These boxes were freshly prepared for each experiment, a mixture of flour and other wheat particles was used for food. From 5 to 15 insects were placed in each box, depending upon the availability of specimens.

These check boxes were placed in the 140 lb. bags of flour until the top of the box was approximately one inch below the desired depth when the flour was loosely packed. The bags were then lifted (five or six times) several inches and allowed to drop. This practice served to pack the flour around the check boxes and the settling of the flour amounted to about one inch.

The bags of flour were then placed in the vault in an upright position. Two bags were used for each experiment where the insects were allowed to remain in the bags 24 hours after exposure.

TABLE I—PENETRATION OF FLOUR BY HCN

Check boxes embedded in 140 lb. bags of flour the remainder of the vault filled with cane seed.
Temperature 60-70 degrees F. Relative humidity 25-40%
Percentage kill of Tribolium adults in Haskellite vault of 480 cubic feet capacity. Final count made 72 hours after exposure.

Fxp. No.	Dosage pounds	Exposure hours	Checks removed at end of exposure 2"	3"	4"	6"	Center	Checks removed 24 hours after end of exposure 4"	6"	Center	Concentration a-Exposed	Checks b-Exposed 30 minutes
c 2	1	8	100	33	10	0	16	—	—	—	—	87
6	2	8	100	80	0	0	6	—	—	—	100	80
1	½	16	100	84	—	0	—	—	11	—	—	0
3	1¼	16	100	77	100	25	40	—	—	—	—	66
5	2	17	100	100	100	60	60	—	—	—	100	80
7	1	20	100	100	40	0	0	g100	70	62	—	40
d 11	1	20	75	100	0	0	0	60	40	20	100	20
10	1¼	20	100	100	40	0	0	100	100	40	100	80
8	1½	20	100	100	100	100	100	g100	100	100	100	80
9	1½	20	100	80	100	40	28	100	100	100	100	80
4	1½	39	100	90	100	80	86	—	—	—	100	50
e 12	1½	20	100	100	100	100	100	100	100	100	100	100
f 13	1	20	100	100	100	100	100	100	100	100	100	100

a—Check boxes exposed in open within the vault.
b—Check boxes dropped through intake air valve 30 minutes before end of exposure.
c—The liquid HCN was applied at intervals; ½ pound at start, ¼ pound 2 hours later; ¼ pound 4 hours later; the total dosage being applied in the 4 hour period
d—Liquid HCN atomized under pressure.
e—Intake valve into vault from meter box leaked during exposure probable overdose 50%
f—Vault empty with exception of two bags flour.
g—Checks buried 3" in flour instead of 4".

TABLE II. EFFECT OF DOSAGE ON PENETRATION

Percentage kill of Tribolium adults 72 hours after exposure.

Removed at end of exposure

Exp. No.	Dosage	Hours Exp.	2"	3"	4"	6"	Center
7	1	20	100	100	40	0	0
11	1	20	75	100	0	0	0
10	1¼	20	100	100	40	0	0
8	1½	20	100	100	100	100	100
9	1½	20	100	80	100	40	28
12	1½	20	100	100	100	100	100

Removed 24 hours after end of exposure

			3"	4"	6"	Center
7			100	—	70	62
11				60	40	20
10				100	100	40
8			100		100	100
9				100	100	100
12				100	100	100

The percetage kill shown in Table II., indicates that the depth of penetration is directly proportional to the dosage, other factors considered equal.

TABLE III. EFFECT OF TIME ON PENETRATION

Percentage kill of Tribolium adults 72 hours after exposure.

Removed at end of exposure

Exp. No.	Dosage	Hours Exp.	2"	3"	4"	6"	Center
2	1	8	100	33	10	0	0
6	2	8	100	80	0	0	0
10	1¼	20	100	100	40	0	0
9	1½	20	100	80	100	40	28

Within the limit of the two-pound dosage, Table III. shows that a definite length of time is necessary for hydrocyanic acid gas to penetrate flour.

Experiments 2 and 6 show that no deeper penetration is obtained with the higher dosage at the eight hour exposure. However, better kills were obtained in experiment 6 in that portion of the flour into which the gas had sufficient time to penetrate. The kill of 10% at the 4" depth in experiment 1 represents only one in-

dividual and is most likely a normal death.

Experiments 9 and 10 show a deeper penetration at lower dosage for twenty hours than experiment 6 with a higher dosage for eight hours.

Experiment 6 penetrated the flour in killing concentrations to a depth of only three inches; 10 penetrated four inches and 9 to the center of the bag.

TABLE IV. EFFECT OF CONTENTS OF VAULT ON PENETRATION

Percentage kill of Tribolium adults 72 hours after exposure.

Removed at end of exposure

Exp. No.	Dosage	Hours Exp.	2"	3"	4"	6"	Center
7	1	20	100	100	40	0	0
11	1	20	75	100	0	0	0
13*	1	20	100	100	100	100	100

Removed 24 hours after exposure

	3"	4"	6"	Center
7	100	3	70	62
11		60	40	20
13*		100	100	100

*Vault empty with exception of the two bags of flour.

In experiments shown in Table IV., all factors were considered equal with the exception of the contents of the vault.

The lower kill obtained when the vault was filled with cane seed shows the seed adsorbed sufficient hydrocyanic acid gas to reduce the penetration.

Results shown in the check boxes exposed for 30 minutes before opening vault and in the check boxes allowed to remain in bag of flour 24 hours after exposure indicate that most of the gas was absorbed, and held during exposure by the outside layers of the cane seed and flour.

Residual HCN Analysis

1½ lbs. Liquid HCN: Exposure 20 hours.
480 cu. ft.

Average sample of cane seed taken from two sacks and sample for analysis taken from mixture of the two.

Flour sample taken from one twenty-four pound bag of short patent flour.

Sample	Lab. No.	HCN Content
Cane seed	1430	81 parts per million
Flour (Original)	1429	78 " " "
" Exposed 3 days		4.5 " " "
" " 1 week		2.7 " " "

The cane seed and the flour were analyzed immediately upon opening the container in which the samples were mailed, and then the flour was analyzd after exposure for three days and one week, respectively, in a cloth bag.

55 bags cane seed in vault—approximately 8,250 pounds
81 ppm. equals 0.000081 pounds HCN per lb. cane seed
0.68825 lbs. HCN adsorbed by cane seed
328 lbs. flour in vault
76 ppm. equals 0.000076 lbs. HCN per lb. flour
0.0249 lbs. HCN adsorbed by flour
Total adsorbed HCN present when analyzed—0.71315.

Conclusions:

1. Flour in 140-pound bags can be successfully penetrated by HCN under the following conditions:
   a. In a metal lined vault.
   b. When the bags are separated to allow the gas to surround each bag.
   c. When sufficient HCN is applied to maintain a lethal concentration after the product fumigated has adsorbed its quota of gas at the prevailing concentration and temperature.
   d. Long exposure, twenty hours, is more economical than increasing the dosage for a shorter exposure.
2. Since the amount of gas adsorbed is inversely proportional to the temperature, increased temperatures should permit either of the following:
   a. The dosage reduced
   b. The exposure shortened.

THE GENUS AGRILUS IN KANSAS

By W. KNAUS, McPherson, Kansas

The following list of species of Agrilus found in

Kansas is based on Bulletin 145 of the U. S. National Museum at Washington, D. C., by Warren S. Fisher of the Museum.

Mr. Fisher devoted several years to the study of this genus as found in North America, examining practically all the representative collections of Agrilus in the United States and Canada. Every described species was redescribed, and 29 new species and varieties were also described. Of the 125 North American species and varieties described, Kansas was represented by 30 species and varieties identified from that state. Most of the species recorded from Kansas are in the collections of the Kansas University at Lawrence, The State Agricultural College at Manhattan and in the collection of the writer.

The sequence of species occurring in Kansas follows that of Mr. Fisher's revision, preceded by the numbers in Leng's "Catalogue of the Coleoptera of America, North of Mexico."

The catalogue number is followed by the name of the county or counties where taken, then the host or food plants and finally, the collections in Kansas having representatives of the species listed; K. U.—Kansas University Collection; K.—Knaus Collection; and K. S. A. C.—Kansas State Agricultural College Collection.

9513 **A. ruficollis** (Fabricius). Crawford, Osage, Douglas and Wilson Counties. Hosts. Blackberry, raspberry and dewberry. K. U. and K.

9499 **A. difficilis** Gory. Douglas and Russell Counties. Hosts. Ash and honey locust. K. U. and K. S. A. C.

9515 **A. masculinus** Horn. Osage County. June 15. R. H. Beamer. K. U.

19660 **A. paramasculinus** Champlain and Knull. Wyandotte County. K. U. Type in T. B. Ashton Collection in Purdue University, Lafayette, Ind.

9523b **A. arcuatus** subspecies **fulgens** LeConte. Douglas County. Host. Hazel. K. U.

9517 **A. defectus** LeConte. St. George, Pottawatomie County and Riley County. March May. Host. White oak. First record of the species in Kansas since 1859 by LeConte.

9539 **A. otiosus** Say. Leavenworth and Saline Counties Host. Hickory. K. U. and K.

9486 **A. pulchellus** (Bland). Belvidere, Kiowa County. July. Medora, Reno County, June. Clark, Linn and Bourbon Counties. Host. Fleabane in Arizona. K. U. and K.

—— **A. pilosicollis** Fisher. Type locality, Garden City, Finney County. Collected by F. B. Milliken, June 18, 1914. Only one female specimen known. Type in U. S. Nat. Museum.

9491 **A. bilineatus** (Weber). Recorded from Kansas but so far as known not in any collection in the state. Hosts. Various species of oaks, chestnut.

9498 **A. acutipennis** Mannerheim. Onaga, Pottawattomie County. K. U. and K.

9551 **A. granulatus** (Say). Saline and Riley Counties. Hosts. Lombardy poplar and cottonwood. K. and K. S. A. C.

—— **A. quadriguttatus** Gory. Douglas, Pottawattomie, Cowley, Cheyenne, Crawford and Rawlins Counties. Host. Willow. K. U., K. S. A. C. and K

9505 **A. obolinus** LeConte. Belvidere and Greensburg, Kiowa County. Morton and Seward Counties. June-July. Found only on elm, at Belvidere. K. U. and K.

9531 **A. fallax** Say. Douglas County. Onaga, Pottawatomie County. Hosts. Honey locust and hackberry. K. U. and K.

9547 **A. obsoletoguttatus** Gory. Atchison County. Hosts. Beech, blue beech,hop-hornbeam, red oak, hickory, and sweet birch. K. U.

9542 **A. politus** (Say). Sheridan, Douglas, Pawnee, Osage, Cheyenne, Johnson, Doniphan, Wallace, Saline, Riley and Republic Counties. June, July. Hosts. Willows and maples. K. U., K. S. A. C. and K.

9542a **A. politus** subspecies **pseudocoryli** Fisher. Douglas County (R. H. Beamer). Host. Hazel. U. S. Nat. Museum.

9522 **A. cephalicus** LeConte. Coffey, Douglas, Wilson, and Leavenworth Counties. Host. Dogwood. K. U. and K.

—— **A. malvastri** Fisher. Meade, Seward, Douglas,

Clark, and Hamilton Counties. West Kansas. (Popenoe). Type locality, Meade County. Host. **Malvastrum coccineum** (Pursh) Gray. K. U. and K.

9544 **A. impexus** Horn. Shawnee, Douglas, Miami, Pottawatomie, Riley, Cowley, Linn, Allen and Smith Counties. Host. Not known. K. U. and K.

—— **A. exiguellus** Fisher. Belvidere, Kiowa County. July. Host. Not known. K.

19664 **A. pseudofallax** Frost. Benedict, Wilson County. Host. Not known. K.

19663 **A. egeniformis** Champlain and Knull. Douglas, Wyandotte, and Leavenworth Counties. Host. Not known. K. U.

9553 **A. lecontei** Saunders. Wilson County. Host. Hackberry. K.

9507 **A. muticus** LeConte. Wallace, Hamilton, Clark, Scott, Gove, Kiowa, and Finney Counties. June, July. Host. Willow. K. U. and K.

9508 **A. lacustris** LeConte. Englewood, Clark County. Phillips and Kingman Counties. June-July. Host. A species of **Croton.** K. U. and K.

9516 **A. pusillus** (Say). Douglas, Saline, Sheridan, Hodgeman, Reno, and Wilson Counties. July. Host. False indigo **(Amorpha fruticosa** Linnaeus.) K. U. and K.

19662 **A. celti** Knull. Douglas, Saline, and Clark Counties. Host. Hackberry. K. U.

9520 **A. egenus** Gory. Rawlins, Osage, and Douglas Counties. Host. Black locust. K. U.

A number of species of Agrilus have been recorded from states adjoining Kansas and most of them no doubt will eventually be added to the Kansas list. These are:-

A. lateralis (Say). Colorado.

A. arcuatus var. **corylicola** Fisher. Mo. and Iowa.

A. geminatus (Say). Mo. and Okla.

A. quercicola Fisher. Colorado.

A. subcinctus Gory. Mo. and Okla.

SCOLOPS OSBORNI BALL IN KANSAS. (HOMOPTERA FULGORIDAE)

By R. H. BEAMER, Lawrence, Kansas.

Scolops osborni Ball was described in the Canadian Entomologist vol. XXXIV, 1902, from seven specimens, three from Iowa collected by Professor Osborn, three from Onaga, Kansas, collected by Crevecoeur and one from Effingham, Kansas, collected by Van Duzee.

One evening about the middle of June, 1927 the writer stopped at a wild grass meadow eleven miles north west of Lawrence, Kansas, to sweep for **Melampsalta calliope** (Walk.) (A small cicada). Numerous sweepings yielded a few cicadas and a great many large Scolops which upon close examination proved to be the rare **Scolops osborni** Ball. Up to this time this species was known only from the types and here as many as twenty adults of this fine insect could be taken from the net at one time. Both short and long winged forms were present as well as both nymphs and adults. It was noted that sweeping that portion of the meadow containing numerous compass plants (**Silphium laciniatum** Linn.) yielded more specimens than other parts of the meadow. Observation of the leaves and stems of this plant, before being disturbed with the net, revealed individuals of all ages sitting about, a great many of them apparently feeding upon the juice of the plant. When darkness finally concluded the collecting, over one hundred and fifty adult specimens were counted.

In September of the same year, at Garnett, Kansas, wild grass meadows containing compass plants yielded only a half dozen mature specimens of this fulgorid. On June 30, 1928, the meadow near Lawrence, Kansas, was visited again and **S. osborni** found in large numbers, both as nymphs and adults. Young compass plants, with two or three leaves, were often observed with ten to twenty individuals upon them. The young tender shoots were much prefered to the older hardened stems. The eggs of this species have not been found. The meadow in question is mowed each summer for the wild hay and is occasionally burned over. Just how this species survives this treatment is rather a mystery but survive it, it does and seemingly in increasing numbers. **Scolops osborni** Ball, once rare is now common.

CORRECTIONS TO SARCOPHAGA PALLINERVIS AND RELATED SPECIES IN THE AMERICAS

By

DAVID G. HALL, Manhattan, Kansas

Since the publication of my paper **"Sarcophaga pallinervis** and related species in the Americas", Annals of the Entomological Society of America, XXI: 331-352, 1928, a few mistakes have been called to my attention and are here corrected.

The name **Sarcophaga minuta**, given by me to a species from Mexico has been found to be preoccupied by **S. minuta** R. D. 1863, Post H. 11, 425, described by him in the genus **Pierretia** R. D. Desvoidy's **minuta** is recognized in Europe as being a synonym of **S. nigriventris,** and **Pierretia** R. D. a synonym of **Sarcophaga** I hereby change the name of my species to **Sarcophaga addentata.**

The type locality of **Sarcophaga orbitalis** Hall, is not Paonia, Colombia, Central America, but Paonia, Colorado, according to Dr. J. M. Aldrich who called the mistake to my attention. A male specimen collected by Dr. C. F. Adams, June 11, 1916, at Atherton, Mo. was recently determined as this species by the author.

NOTES ON PHYLLOPHAGA ILICIS KNOCH. (COLEOP., SCARABAEIDAE).

By

W. R. HORSFALL, Manhattan, Kansas.

These observations were made incidental to some other work in connection with a study of white grubs and as a sequel to some observations made by McColloch, Hayes, and others at the Kansas Agricultural Experiment Station.

Phyllophaga ilicis has been considered to be a rare species in the vicinity of Manhatan, Kansas. According to Hayes*, a total of 91,490 May beetles, representing 25 species, were collected at Manhattan during the period 1916 to 1922. Of these, only nine were **P. ilicis.**

In the fall of 1928, the writer began an ecological study of the white grubs and May beetles, with special reference to their soil habitats. One of the areas selected for this work was a woodland on the east slope of Mt. Prospect, a small hill about one-half mile southeast of Manhattan. In this particular area, **P. ilicis** proved to be the dominant species. During the past nine months, 108

*Hayes, W. P., 1925. A comparative study of the History of Certain Phytophaga Scarabaeid Beetles. Kans. Agri. Exp. Sta., Tech. Bull. 16, p. 72.

specimens were collected in and on the soil of an area which was less than one-half acre in size. The abundance of this species in this limited region emphasizes the frequent local distribution of the various species of Phyllophaga and the need for careful collecting in all types of habitats.

The location that seems to be the most favorable for **P. illicis** is in the woods where the soil is neutral or alkaline, and where the trees are largely **Quercus muehlenbergii.** In the particular locality where the author did this work, the grove was located on a northeast slope having a shallow surface soil above a clay subsoil with a layer of limestone gravel below. The rock layer varied from 9 to 12 inches below the surface in most places.

Pupation occurred at a depth that varied with the depth of the top of the rock layer, and the average for seven different places was between 12 and 14 inches from the surface of the ground. The exact time of the emergence of the adults was not determined because the observations were not started until after emergence had ceased. Hibernation of the beetles occurred in the same cells in which pupation took place.

As soon as the ice starts to melt in the spring, the adults become active. This year the ascent was started about the first of March.

ANNOUNCEMENT

The sixth annual meeting of the Rocky Mountain Conference of Entomologists will be held in Pingree Park, Colorado, August 19-24, 1929. Those planning on attending this conference should write to Prof. Geo. M. List, Fort Collins, Colo. It is important that those who have charge of the arrangements know at an early date about how many are going to be present, as the crowd must be cared for at a distance of over 50 miles from the base of supplies.

Geo. M. List, Secretary

MEDORA FIELD TRIP

President H. B. Hungerford has announced a field meeting of the Kansas Entomological Society, to be held at Medora, Kansas, July 4, 1929.

Bring your camping equipment, **Water,** food and insect collecting apparatus.

R. L. Parker, Secretary.

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